

Annual Monitoring Report

Monitoring Year 4 of 7

FINAL

601 East Stream Restoration Project
NCDMS Contract No.: 004925
NCDMS Project No.: 95756
USACE Permit Action ID: 2013-00265
DWR Project No.: 14-0547

Union County, NC
Data Collected: November 2018
Date Submitted: January 2019



Submitted to:

North Carolina Division of Mitigation Services
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January 25, 2019

Paul Wiesner
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RE: 601 East Stream Restoration Site: MY4 Monitoring Report (NCDMS ID 95756)

Listed below are comments provided by DMS on January 4, 2019 regarding the 601 East Stream Restoration Site: Year 4 Monitoring Report and RES' responses.

General: The 2018 credit release meeting was held on April 24, 2018. Invasives on the site; beaver and beaver dams on the site; and encroachment on the site were discussed. RES indicated that all of the issues reported in the 2017 monitoring report (MY3) were resolved in early 2018 (March). The IRT requested a memo from RES to document the resolutions discussed. The IRT agreed to release the credits on the site as proposed upon approval of the 601 East memo. The requested memo was submitted to the IRT as requested and is included as Appendix F in the MY4 (2018) report.

The IRT made a credit release site visit on July 12, 2018. Please document the IRT credit release site visit in the revised MY4 report. Any IRT comments, questions or concerns should be included in the meeting minutes. Meeting minutes can be included briefly in the report text or as a report Appendix in the final MY4 report.

[The IRT decided to forgo the July 12, 2018 site visit therefore there are no meeting minutes.](#)

General: Conservation Easement encroachment has been an issue on the 601 East site since MY1 (2015). DMS understands that the encroachment areas were remarked and replanted in March 2018. In the revised report, please confirm that encroachment has been eliminated based on RES's November 2018 site visit and monitoring data collection. If encroachment has not been eliminated, please discuss areas, issues and proposed resolutions in the revised MY4 report.

[As of November 2018, the encroachment has been eliminated. This has been added to Section 1.4.1.](#)

Section 1.4 – Project Performance: The NCDMS website for the project document portal should be updated to: <https://deq.nc.gov/about/divisions/mitigation-services/dms-projects>

[Done.](#)

Section 1.4.1 – Vegetation: The aquatic invasive “Parrot Feather” was a point of discussion during the July 12, 2018 IRT site visit. The May 3, 2018 adaptive management memo states that invasive treatment results will be described in the MY4 report. Please describe MY4 treatment efforts and results for the invasive species reported on the site and discuss proposed MY5 (2019) invasive treatment efforts.



RES used an aquatic safe herbicide to treat the Parrot Feather in the spring and fall of 2018. The Parrot Feather was still present in the areas noted on the CCPV during the November 2018 site visit. RES will reevaluate the efficacy of the aquatic herbicide in early 2019 and continue to treat the Parrot Feather if determined to be necessary. This has been added to the report.

Section 1.4.2 – Stream Geomorphology: Please note that beaver should be trapped, and the associated dams removed from the project site for the entirety of the monitoring term. This should be completed as quickly as possible to avoid project damage and abnormal monitoring data. Beaver management, including trapping and dam removal, will be performed again in MY5. This has been added to the report.

Were any dry channels observed on the site in the MY4 monitoring period on Reach 1 or Reach 2? Please update the text accordingly as this has been a previous DMS project concern. RES made site visits in March and November 2018. Dry channels on Reach 1 or Reach 2 were not observed during either site visit. Photo documentation from November 2018 is in Appendix B. This has been added to the report.

Section 1.4.3 – Stream Hydrology: The report indicates that MY4 (2018) bankfull events were documented via wrack lines and only one event was noted at each location. Please confirm that the two (2) crest gauges installed on the site are functioning properly and have been maintained. Based on the precipitation data it appears likely that the site had more than 1 bankfull event in 2018. If the installed crest gauges are not capturing accurate yearly bankfull events, DMS recommends installing self-recording transducers. Both crest gauges were overrun with ants in MY4. RES cleaned the crest gauges out and expects them to record bankfull events in MY5.

CCPV Sheets/ Report Text: In the report text, please describe/ discuss the erosional feature shown on Figure 2b (Reach 1). The erosional feature is a small headcut that formed at the edge of the easement from a field drain. The feature has stabilized with the maturation of vegetation in the buffer. If conditions worsen, RES will stabilize the headcut with rock and add coir logs along the feature. This has been added to the report.

Table 2: Please list all invasive-exotic treatments, supplemental plantings, maintenance activities and beaver removal efforts in Table 2. The table should report all efforts post construction. Done.

Table 13: Two (2) of the table entries in Year 3 have “ * ”; however, there are no footnotes included. Please include the footnotes. In the report text (or the missing footnote), please describe the difference in measurements for XS-17 between Year 2, Year 3 and Year 4. In MY3, the beaver dam directly downstream caused unusually high water and localized bank erosion. This footnote has been added back to Table 13.

Electronic Deliverables: Please provide ALL project GIS shapefiles (stream layer, TOB, etc.) in the FINAL MY4 electronic deliverable CD. Done.

Prepared by:



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1.0 PROJECT SUMMARY

1.1. Goals and Objectives

The project goals address stressors identified in the TLW and include the following:

- Reduce water quality stressors originating in and around the project area affecting the project
- reaches and downstream watercourses, which include population of the Savannah Lilliput
- (*Toxolasma pullus*) and the Carolina Creekshell (*Vilosa vaughiana*), both listed species of concern. Specifically involving:
 - Reducing turbidity and sediment loading
 - Input reductions of nutrients and crop protection chemicals
 - Improving thermoregulation
- Improving aquatic habitat quality and diversity within project reaches
- Improving recruitment of instream fine organic matter (FOM) in the near term and both FOM and
- large wood in the long term
- Improving terrestrial habitat diversity and quality in the vicinity of project reaches
- Establishing habitat continuity between the reach headwaters and Lanes Creek
- Improving flood flow attenuation and floodplain interaction

The project goals are addressed through the following project objectives:

- Restore or enhance reach pattern, dimension, and profile
- Stabilize eroding stream banks
- Install stream structures to maintain grade and improve bed form complexity
- Implement BMP detention devices on lateral agricultural drainages
- Install diverse native riparian buffer
- Removal of invasive exotic plant species
- Secure a protective conservation easement and establish fencing as needed

1.2. Success Criteria

The success criteria for the 601 East Stream Restoration Site follows accepted and approved success criteria presented in the USACE Stream Mitigation Guidelines and subsequent NCDMS and agency guidance. Specific success criteria components are presented below.

1.2.1. Stream Restoration

Morphologic Parameters and Channel Stability – Restored and enhanced streams should demonstrate morphologic stability to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the period that follows construction and some subsequent change/variation is also to be expected. However, the observed change should not be unidirectional such that it represents a robust trend. If some trend is evident, it should be modest or indicate migration to another stable form. Annual variation is to be expected, but over time this should demonstrate equilibrium on the reach scale with the maintenance of or even a reduction in the amplitude of variation. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed and the design type/intent (i.e. threshold versus free form alluvial channels).

Dimension – General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. However, some change is natural and expected and can even indicate that the design was successful and appropriate for the hydrologic and sediment regime. Examples include depositional processes resulting in the development of constructive features on the banks and floodplain such as an inner berm, a slightly narrower channel, modest natural levees, and general floodplain deposition.

For stream dimension, cross-sectional overlays and key parameters such as cross-sectional area, and the channel's width to depth ratios should demonstrate modest overall change and patterns of variation.

Significant widening of the channel cross-section or trends of increase in the cross-sectional area generally represent concern, although some adjustment in this direction is acceptable if the process is arrested after a period of modest adjustment. In the case of riffle cross sections, maintenance of depths that represent small changes to target competence (e.g. consistently low BHRs <1.2) would also reflect stability. Although a pool cross-section may experience periodic infilling due to watershed activity and the timing of events relative to monitoring, the majority of pools within a project stream reach/component should demonstrate maintenance of greater depths and low water surface slopes over time. Rates of lateral migration need to be moderate. Bank pins will be installed to monitor rates of erosion.

Pattern and Profile – Pool depths may vary from year to year, however the majority of pools should maintain depths that are distinct in the profile and are readily observed. Pattern measurement will not be collected unless observations indicate a detectable change based on observations and/or dimension measurements.

Substrate – Generally it is anticipated that the bed materials will coarsen over time. The majority of riffle pebble counts should indicate maintenance or coarsening of the substrate. The D50 and D84 of the substrate should show a coarser distribution of bed materials in riffles and finer size class distribution in pools.

Sediment Transport – Depositional features should be consistent with a stable stream that is effectively managing its sediment load. Point Bar and inner berm features should develop without excessive encroachment of the restored channel. Trends in the development of systemic robust mid-channel or alternating bar features will be considered a destabilizing condition and may require intervention.

The tributaries outside of the conservation easement will be observed yearly and the monitoring report will document the function of the upstream basins in capturing excess sediment produced by observed degradation in the narrative. A specific performance standard has not been added.

1.2.2. Surface Water Hydrology

Monitoring of stream water stages through a staff gauge should show recurrence of bankfull flow on average every 1 to 2 years. Throughout the monitoring period, the surface water stage should achieve bankfull or greater elevations at least twice. The bankfull events must occur during separate monitoring years.

1.2.3. Vegetation

The vegetation monitoring will be conducted according to the Carolina Vegetation Survey (CVS) – EEP protocol Version 4.2 (Lee et al 2008). Vegetation monitoring plots will be 100 square meters in size and will be conducted according to the Level I protocol which has a focus on planted stems only. The purpose of this level of monitoring is to determine the pattern of installation of plant material with respect to species, spacing, density, and to monitor the survival and growth of those installed species. The success criteria for the preferred species in the restoration areas will be based on annual and cumulative survival and growth over seven (7) years. Survival on preferred species must be at a minimum 320 stems/acre at the end of the three years of monitoring and 260 stems/acre after five years. At year 7, density must be no less than 210 seven-year-old planted stems/acre. Level II of the CVS protocol, which includes natural stems and planted stems, will be followed for the monitoring year 2 and subsequent years until the project close out year.

1.3. Project Setting and Background

The 601 East Stream Restoration Site is located in Union County, approximately 13 miles south of Monroe, NC (**Figure 1**). The site encompasses 12.8 acres of formerly agricultural land and includes portions of Tanyard Branch, a tributary of Lanes Creek. The Site is located within the Yadkin River Basin, United States Geological Survey (USGS) 14-digit Hydrologic Unit 03040105081010 and the North Carolina Division of Water Resources (NCDWR) sub-basin 03-04-14. The drainage area of Tanyard Branch at the downstream end of the site is 0.56 square mile (354 acres). Land use within the watershed is predominately agriculture with the remaining land use composed of low density residential and forested areas.

Following 2016 monitoring the NCIRT requested a review of the differential between the Approved Mitigation Plan and Baseline Monitoring Report. The table below details the discrepancies by reach. The primary cause of increased baseline SMUs is survey methodology (thalweg vs. centerline). The Mitigation Plan lengths were based on centerline. Additionally, there were likely minor field adjustments during construction.

Reach	Mitigation Type*	Proposed Length (LF)	Mitigation Ratio	Proposed SMUs	Baseline SMUs
Reach A	Buffer Establishment	215	5:1	43	43
Reach 1a	P1 Restoration	350	1:1	350	350
Reach 1b	Enhancement I	85	1.5:1	56	57
Reach 1c	Enhancement I	155	1.5:1	103	103
Reach 1d	P1 Restoration	800	1:1	800	803
Reach 2a	Enhancement I	40	1.5:1	26	30
Reach 2b	Enhancement I	120	1.5:1	80	85
Reach 2c	P1 Restoration	724	1:1	724	730
Reach 3a	P1 Restoration	368	1:1	368	369
Reach 3b	P1 Restoration	650	1:1	650	649
Reach 3c	P3 Restoration	480	1:1	480	495
Total		3,987		3,680	3,714

*P1=Priority 1, P3=Priority 3

**The contracted amount of credits for this Site was 3,576 SMUs

1.4. Project Performance

Monitoring Year 4 (MY4) data was collected in November 2018. Monitoring activities included visual assessment of all reaches and the surrounding easement, 20 permanent photo stations, nine pebble counts, and nine bankpin arrays. Per the Approved Mitigation Plan, vegetation and cross-section monitoring was not performed in MY4. Summary information and data related to the occurrence of items such as beaver activity or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. A visual overview of the site can be seen in the Current Conditions Plan View Maps (**Figure 2**). Photographs taken at permanent stations throughout the project site also display general site conditions (**Figure 3**). Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on the NCDMS website (<https://deq.nc.gov/about/divisions/mitigation-services/dms-projects>). All raw data supporting the tables and figures in the appendices is available from DMS upon request.

1.4.1. Vegetation

Visual assessment of the easement (**Table 5; Figure 2**) indicates vegetation is well established throughout the easement. The bare areas and encroachment areas that were lacking vegetation were addressed in March 2018. 250 container trees were planted in these areas and the encroachment on Reach 3 and 4 was blocked off by t-posts. Additionally, the Chinese Privet and Parrot Feather areas were treated in the spring and fall of 2018. RES used an aquatic safe herbicide to treat the Parrot Feather. As of November 2018, it was still present in the areas noted on **Figure 2**. RES will reevaluate the efficacy of the aquatic herbicide in early 2019. These areas will continue to be monitored and treated as necessary. Per the November 2018 site visit, the encroachment has been eliminated. A memo from May 2018 that describes the Adaptive Management in more detail is attached in **Appendix F**.

Monitoring of the 10 permanent vegetation plots was not completed in MY4. The vegetation plots will be monitored again in MY5 and MY7.

1.4.2. Stream Geomorphology

Visual assessment of the stream was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation (**Table 6**). The erosional feature noted in the right buffer of Reach 1 is a headcut that formed at the edge of the easement from a field drain. The feature has stabilized with the maturation of vegetation in the buffer. If conditions worsen, RES will stabilize the headcut with rock and add coir logs along the feature. The major stream problem areas from MY3 were two beaver dams on Reach 4. These dams and beavers were removed in March 2018 and the dams were completely taken out and the banks were stabilized and replanted. The beavers, however, returned in MY4 and built new dams on Reach 4. Beaver management, including trapping and dam removal, will be performed again in MY5.

Geomorphic data was not collected in MY4 and will be collected again in MY5 and MY7.

Substrate monitoring was performed during MY4. Pebble count D₅₀ was fine gravel for Reach 1, fine gravel for Reach 2, coarse gravel for Reach 3, and medium gravel for Reach 4 (**Table 12; Charts 1-5**). The channel substrate will be monitored in future years for shifts in particle size distributions.

The bank pin arrays indicate that no erosion is taking place in the pools at cross-sections (**Table 13**).

1.4.3. Stream Hydrology

During MY4 bankfull events were documented on both the Reach 2 and Reach 3 via wrack lines (**Table 14; Figure 7**). Project site precipitation data can be found in **Table 15**. Dry channels were not observed in MY4 during either site visit in March and November 2018. Photo documentation of the stream from November 2018 is in **Appendix B**.

Summary information/data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on NCDMS' website. All raw data supporting the tables and figures in the appendices is available from NCDMS upon request.

2.0 METHODS

Visual assessments of the project were performed at the beginning and end of the monitoring year. Permanent photo station photos were collected during vegetation monitoring. Additional photos of vegetation or stream problem areas were documented with photographs throughout the project area.

Geomorphic measurements (MY0, MY1, MY2, MY3, MY5, MY7) were taken during low flow conditions using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section and profile data were collected in the field and geo-referenced (NAD83 State Plane feet FIPS 3200). Morphological data was limited to 18 cross-sections. Survey data was imported into CAD, ArcGIS, and Excel for data processing and analysis. Channel substrate was characterized using a Wolman Pebble Count as outlined in Harrelson et al. (1994) and processed using Microsoft Excel.

Vegetation success (MY0, MY1, MY2, MY3, MY5, MY7) is being monitored using 10 permanent monitoring plots. Vegetation monitoring followed CVS-EEP Level 1 Protocol for MY1 and is following Level 2 Protocol Version 4.2 for monitoring years 2-7 (Lee et al. 2008). Level 2 Protocol includes analysis of species composition and density of planted species. Data is processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with rebar and photos of each plot taken from the origin each monitoring year. The locations of the three temporary plots surveyed in Years 2 and 3 were randomly selected within the replant areas. The plots were surveyed by pulling tapes to form 10 x 10 meter plots then counting all woody stems within the plots.

Precipitation data was reported from the NCCRONOS station number 315771 in Monroe, NC. Two crest gauges were installed on the mainstem channel, one upstream of Lansford Road in Reach 2 and another downstream of Lansford Road in Reach 3. During quarterly visits to the site, the height of the cork-line was recorded.

3.0 REFERENCES

Resource Environmental Solutions, LLC. 2015. 601 East Stream Restoration, Baseline Monitoring Document and As-Built Baseline Report Final, Union County, North Carolina. NCEEP Project No. 95756

Harrelson, Cheryl, C. Rawlins and J. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Gen. Tech. Rep. RM-245. Rocky Mountain Forest and Range Experiment Station. USDA Forest Service. Fort Collins, Colorado

Lee, M.T.,R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. <http://cvs.bio.unc.edu/methods.htm>; accessed November 2008.

Appendix A

General Tables and Figures

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts

Table 4. Project Information and Attributes

Figure 1. Project Vicinity Map

Figure 2. Current Conditions Plan View Map

Appendix A – General Tables and Figures

Table 1: Project Components and Mitigation Credits									
601 East Stream Restoration Site									
Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	3638.67	43							
Project Components									
Project Component - or- Reach ID	Stationing/Location		Existing Footage/Acreage		Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation	
								Ratio	Credits
Reach A Ephemeral	5+45 – 7+60		215			Buffer establishment and BMP sediment import reduction	215	1 : 5	43
Reach 1a Intermittent	7+60 – 11+10		336		P1	R	350	1 : 1	350
Reach 1b Intermittent	11+10 – 11+95		85		Enhancement	E1	85	1 : 1.5	56.7
Reach 1c Perennial	11+95 – 13+50		136		Enhancement	E1	155	1 : 1.5	103.3
Reach 1d Perennial	14+00 – 22+00		790		P1	R	800	1 : 1	800
Reach 2a Perennial	22+00 – 22+40		40		Enhancement	E1	40	1 : 1.5	26.7
Reach 2b Perennial	22+80 – 24+00		125		Enhancement	E1	120	1 : 1.5	80
Reach 2c Perennial	24+00 – 31+24		669		P1	R	724	1 : 1	724
Reach 3a Perennial	43+06 – 46+60		80' active channel 112' relic channel		P1	R	368	1 : 1	368
Reach 3b Perennial	47+20 – 53+70		502' relic channel		P1	R	650	1 : 1	650
Reach 4 Perennial	53+70 – 58+50		470' relic channel		P3	R	480	1 : 1	480
Component Summation									
Restoration Level	Stream (linear feet)		Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)	Mitigation Credits	
	Riverine	Non-Riverine							
Restoration	3372								3372
Enhancement									
Enhancement I	400								266.6
Enhancement II									
Creation									
Preservation/Other	215								43
HQ Preservation									
BMP Elements									
Element	Location				Purpose/Function			Notes	
FB, LS, S, FS	Ephemeral Channel 5+45 – 7+60				Slowing the water down for settling and filtering excess sediment			Sediment expected from future degradation upstream	
BMP Elements									
BR = Bioretention cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spread; NI = Natural Infiltration Area; FB = Forested Buffer									

Note: Stream credit calculations were originally calculated along the as-built thalweg. Based on the April 3, 2017 IRT Credit Release Meeting, these stream credits have been reverted back to the amounts in the IRT approved mitigation plan.

Table 2. Project Activity and Reporting History 601 East Stream Restoration Site		
Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	May 2013	Jan 2014
Final Design – Construction Plans	Sept 2013	Jan 2014
Construction	-	Dec 2014
Containerized, bare root and B&B plantings	-	Jan 2015
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Feb 2015	Feb 2015
Year 1 Monitoring	Nov 2015	Nov 2015
Supplemental Planting (Entire Site)	-	Apr 2016
Year 2 Monitoring	Sept 2016	Oct 2016
Year 3 Monitoring	Stream - July 2017 Vegetation - Oct 2017	Jan 2018
Supplemental Planting, Encroachment Blocking, Beaver Removal, Invasive Treatment	-	Mar 2018
Invasive Treatment	-	Sept 2018
Year 4 Monitoring	Nov 2018	Jan 2019
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Table 3. Project Contact Table 601 East Stream Restoration Site	
Designer Primary project design POC	Ward Consulting Engineers, P.C. (WCE) 4805 Green Road, Suite 100, Raleigh, NC 27616 Becky Ward (919) 870-0526
Construction Contractor Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Joseph Wright (919) 663-0810
Planting Contractor Planting contractor POC	H & J Forest Services 1416 Ocean Boulevard, Holly Ridge, NC 28445 (910) 512-6754
Construction Survey Contractor Survey contractor POC	Turner Land Survey, PLLC 3719 Benson Drive, Raleigh, NC 27629 Elizabeth Turner (919) 827-0745
Seeding Contractor Construction contractor POC	Wright Contracting P.O. Box 545, Siler City, NC 27344 Andrew Dimmette (919) 663-0810
Seed Mix Sources	Green Resource - Raleigh, NC As Purchased by EBX (919) 829-9909 x213
Nursery Stock Suppliers	Arbor Gen - Blenheim, SC (800) 222-1290 NC Forest Service Nursery - Goldsboro, NC (888) 628-7337
[Baseline] Monitoring Performers	Ward Consulting Engineers, P.C. 4805 Green Road, Suite 100, Raleigh, NC 27616
Stream Monitoring POC	Rachael Zigler - WCE - (919) 870-0526
Vegetation Monitoring POC	Chris Sheats - The Cantena Group - (919) 732-1300
Monitoring Performers (MY1-MY2) 2015-2016	Equinox 37 Haywood Street, Suite 100 Asheville, NC 28801
Stream Monitoring POC	Drew Alderman (828) 253-6856
Vegetation Monitoring POC	Drew Alderman (828) 253-6856
Monitoring Performers (MY3+)	Resource Environmental Solutions (RES) 302 Jefferson Street, Suite 110 Raleigh, NC 27605
Stream Monitoring POC	Ryan Medic (919) 741-6268
Vegetation Monitoring POC	Ryan Medic (919) 741-6268

Table 4. Project Baseline Information and Attributes				
601 East Stream Restoration Site				
Project Information				
Project Name		601 East Stream Restoration Site		
County		Union County		
Project Area (acres)		12.78		
Project Coordinates (latitude and longitude)		34° 50' 21.62" N, 80° 25' 32.26"N		
Project Watershed Summary Information				
Physiographic Province		Piedmont		
River Basin		Yadkin River Basin		
USGS Hydrologic Unit 8-Digit		USGS Hydrologic Unit 14-digit	3040105081010	
DWQ Sub-basin		3/4/2014		
Project Drainage Area (acres)		361.33		
Project drainage Area Percentage of Impervious Area		2%		
CGIA Land Use Classification		2.01.01.07 Annual Row Crop Rotation		
Reach Summary Information				
Parameters	Reach 1	Reach 2	Reach 3	Reach 4
Length of reach (LF)	1,418; 1,393 LF Restored	906; 902 LF Restored	1,080; 1,018 LF Restored	Relic Channel, 495 LF Restored
Valley Classification	II	II	VIII	VIII
Drainage area (acres)	109	135	333	359
NCDWQ stream identification score	Intermittent: 19.5 Perennial: 33.5	33.5	33.5	33.5
NCDWQ Water Quality Classification	13-17-40-(1)	13-17-40-(1)	13-17-40-(1)	13-17-40-(1)
Morphological Description (stream type)	G4/B4/C4b	C4/E4/DA	C4/G4	G4
Evolutionary trend (reference channel evolution model used)	G	C/DA	G	G
Underlying mapped soils	Intermittent: Tatum gravelly silty Perennial: Cid channery silt loam	Cid channery silt loam, Tatum gravelly silt loam	Chewacla silt loam	Chewacla silt loam
Drainage class	Well Drained	Moderately Well Drained	Somewhat Poorly Drained	Somewhat Poorly Drained
Soil Hydric status	Non Hydric	Non Hydric	Non Hydric	Non Hydric
Slope	2%	0.84%	0.67%	1.25%
FEMA classification	N/A	N/A	N/A	N/A
Native vegetation community	Agriculture along upstream The remaining stream buffer within this reach is composed of Willow Oak, Red Maple, River Birch, Black Willow, Elderberry, and Blackberry.	Canopy species include Willow Red Maple, Sweetgum, Eastern Wetland A is composed of Cattails, spike rush arrow-arum, and duckweed.	Canopy species include Red Maple, Hackberry, Willow Oak, and Sweetgum. The presence of Chinese privet outcompete any shrub and herb layer.	Canopy species include Red Maple, Hackberry, Willow oak, and Sweetgum. The presence of Chinese privet outcompete any shrub and herb layer.
Percent composition of exotic invasive vegetation	0%	50% of Parrot feather	5% of Japanese stilt grass, 80% Chinese privet, and kudzu	80% Chinese privet

Table 4 con't. Project Baseline Information and Attributes 601 East Stream Restoration Site			
Wetland Summary Information			
Parameters	Wetland 1		
Size of Wetland (acres)	0.43 ac		
Wetland Type (non-riparian, riparian riverine,	Non-Tidal Freshwater Marsh		
Mapped Soil Series	Cid channery Silt Loam		
Drainage class	Moderately Well Drained to Somewhat Poorly Drained		
Soil Hydric Status	Non-Hydric		
Source of Hydrology	Tanyard Branch headwaters, groundwater, and adjacent runoff		
Hydrologic Impairment	Wetland A formed from accumulating sediments filling the channel resulting in a braided channel system through the wetland.		
Native vegetation community	Herbaceous -Vegetation is dominated by herbaceous vegetation such as Cattail (<i>Typha latifolia</i>), Bulrush (<i>Scirpus cyperinus</i>), Common Rush (<i>Juncus effuses</i>). Some tree species such as Black Willow (<i>Salix nigra</i>), and Red Maple (<i>Acer rubrum</i>) are present in the wetland margins.		
Percent composition of exotic invasive vegetation	95% -The invasive Parrot Feather (<i>Miriophyllum aquaticum</i>) is dominant throughout the wetland where there is standing water.		
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States-Section 404	Yes	SAW 2013-00265; EEP IMS #95756	
Waters of the United States – Section 401	Yes	DWR# 14-0547	
Endangered Species Act	No	Yes	ERTR
Historic Preservation Act	No	Yes	ERTR
Coastal Zone Management Act (CZMA)/Costal Area Management Act (CAMA)	No	N/A	
FEMA Floodplain Compliance	No	N/A	
Essential Fisheries Habitat	No	N/A	

Driving Directions: From Monroe drive south on Hwy. 601. Turn left on Landsford Road. Site is located on the left and right .25 miles down and accessed from a parking area on the south side of Landsford Road.

The subject project site is an environmental restoration site of the NCDMS and encompassed by a recorded conservation easement, but is bordered by land with private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access to the general public is not permitted. Access by authorized personnel of state and federal agencies or their designee/contractors involved in the development, oversight, and stewardship of the restoration site is permitted within the terms and timeframes of their defined role. Any intended site visitation or activity by any person outside these previously sanctioned roles and activities requires prior coordination with NCDMS.

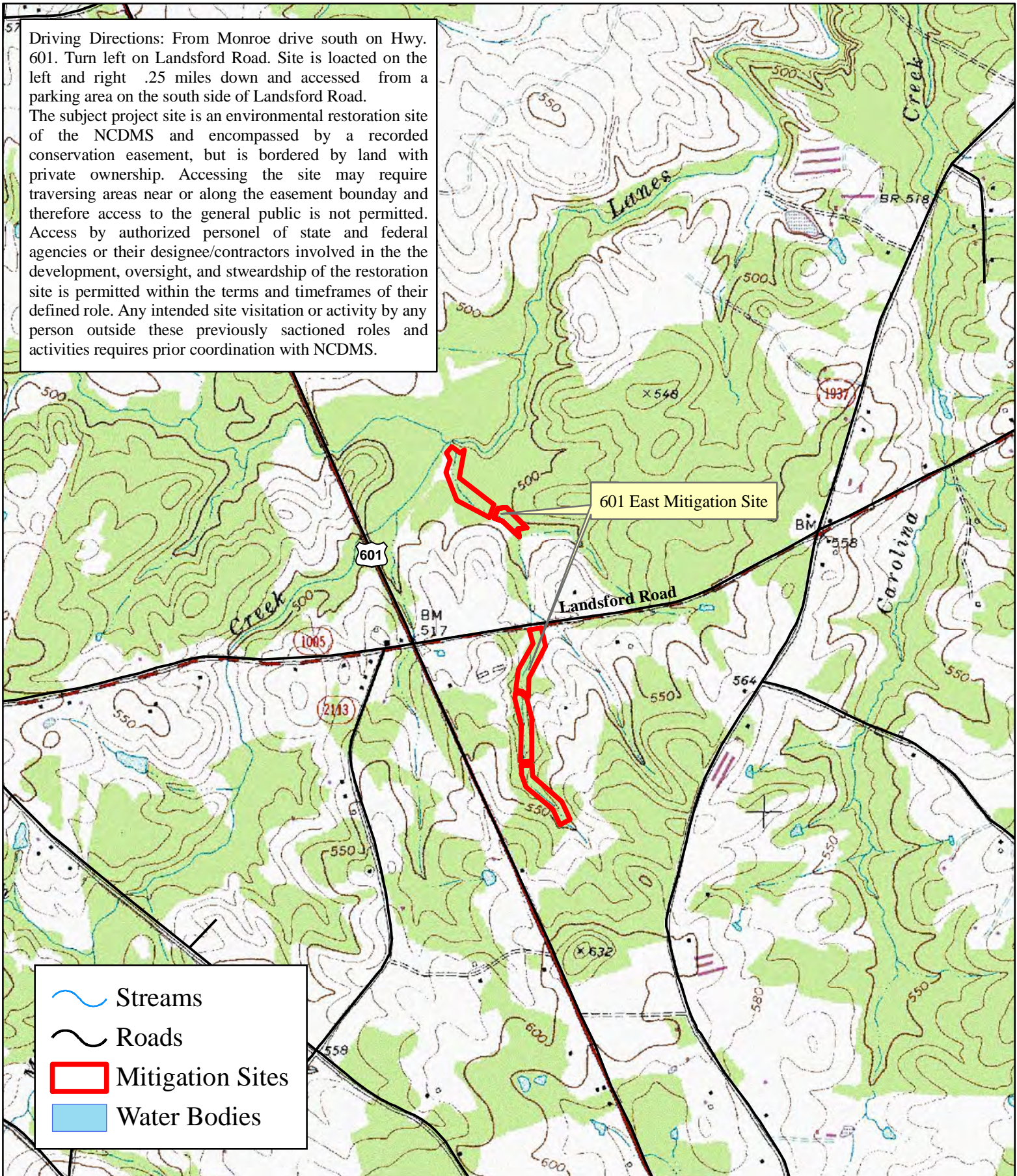
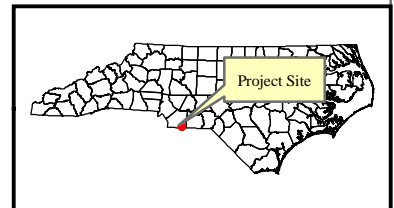
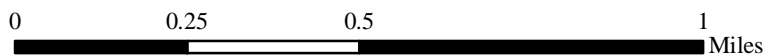
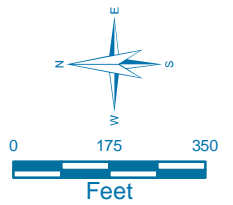


Figure 1
601 East Mitigation Site
Project Vicinity Map





1 inch = 350 feet

Figure 2a

**601 East Stream
Restoration Project
MY4 2018**

**Current Conditions
Overview Map**

Date: 11/29/2018 Drawn by: RTM

LEGEND

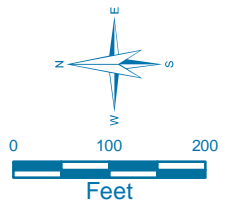
- █ Conservation Easement
- Stream Restoration
- Cross Section
- Structure
- Top of Bank
- Crest Gauge
- Bankpin Array
- Photo Station
- Vegetation Success
- MY3 Criteria Met

Vegetation Condition Assessment

		Target Community		
		Present	Marginal	Absent
Invasive Species	Absent	No Fill	Vertical Lines	Vertical Lines
	Present	Diagonal Lines	Diagonal Lines	Diagonal Lines



Document Path: S:\BIBES\Projects\601 - 601 East Stream\601\Map\601 MY4 2018\601 MY4 2018 Overview Map.mxd



1 inch = 200 feet

Figure 2b

**601 East Stream
Restoration Project
MY4 2018**

**Current Conditions
Plan View**

Date: 11/29/2018

Drawn by: RTM

LEGEND

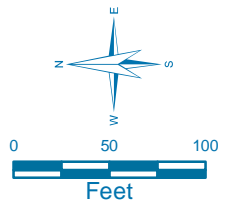
- ▭ Conservation Easement
- Stream Restoration
- Structure
- Top of Bank
- Cross Section
- ★ Photo Station
- ▭ Bankpin Array
- ⊕ Crest Gauge
- Vegetation Success
- MY3 Criteria Met

Vegetation Condition Assessment

		Target Community		
		Present	Marginal	Absent
Invasive Species	Absent	No Fill	Marginal	Absent
	Present	Marginal	Marginal	Absent



Source: 2013 NC OneMap Aerial Imagery



1 inch = 100 feet

Figure 2c

**601 East Stream
Restoration Project
MY4 2018**

**Current Conditions
Plan View**

Date: 11/29/2018

Drawn by: RTM

LEGEND

- Conservation Easement
- Stream Restoration
- Cross Section
- MY4 SPA
- Structure
- Top of Bank
- ★ Photo Station
- ⚠ Bankpin Array
- ⊕ Crest Gauge
- Vegetation Success
- MY3 Criteria Met

Vegetation Condition Assessment

		Target Community		
		Present	Marginal	Absent
Invasive Species	Absent	No Fill	No Fill	No Fill
	Present	No Fill	No Fill	No Fill



Source: 2013 NC OneMap Aerial Imagery

Appendix B

Visual Assessment Data

Table 5. Vegetation Condition Assessment

Table 6. Visual Stream Morphology Stability Assessment

Figure 3. 2018 Photo Station Photos

Figure 4. 2018 Problem Area Photos

**Table 5. Vegetation Condition Assessment
601 East Stream Restoration Site
Planted Acreage 12.8
Easement Acreage 12.8**

Vegetation Category	Definitions	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	Red Simple Hatch	0	0.00	0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4 or 5 stem count criteria.	Orange Simple Hatch	0	0.00	0%
Totals			0	0.00	0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	Orange Simple Hatch	0	0.00	0%
Cumulative Totals			0	0.00	0%
Vegetation Category	Definitions	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	Yellow Crosshatch	8	0.44	3%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	Red Simple Hatch	0	0.00	0%

N/A - Item does not apply.

**Table 6. Visual Stream Morphology Stability Assessment
601 East Stream Restoration Site - Reach 1
Assessed Length 1,393 feet**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	32	32			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	33	33			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	33	33			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	33	33			100%			
		2. Thalweg centering at downstream of meander bend (Glide).	33	33			100%			
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
	Totals				0	0	100%	N/A	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	N/A	N/A			N/A			

**Table 6 cont'd. Visual Stream Morphology Stability Assessment
601 East Stream Restoration Site - Reach 2
Assessed Length 902 feet**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	16	16		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	17	17		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	17	17		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	17	17		100%				
		2. Thalweg centering at downstream of meander bend (Glide).	17	17		100%				
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
	Totals					0	0	100%	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	N/A	N/A			N/A			

**Table 6 cont'd. Visual Stream Morphology Stability Assessment
601 East Stream Restoration Site - Reach 3
Assessed Length 1,018 feet**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	18	18		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	18	18		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	18	18		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	18	18		100%				
		2. Thalweg centering at downstream of meander bend (Glide).	18	18		100%				
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
	Totals				0	0	100%	N/A	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	N/A	N/A			N/A			

**Table 6 cont'd. Visual Stream Morphology Stability Assessment
601 East Stream Restoration Site - Reach 4
Assessed Length 495 feet**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate.	9	9		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	9	9		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	9	9		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	9	9		100%				
		2. Thalweg centering at downstream of meander bend (Glide).	9	9		100%				
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
	Totals					0	0	100%	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	2	2			100%			

Figure 3. 2018 Photo Station Photos



Reach 1 – Permanent Photo Station 1
Top of Project – Looking Downstream



Reach 1 – Permanent Photo Station 2
Cross Section 1 – Looking Downstream



Reach 1 – Permanent Photo Station 3
Cross Section 2 – Looking Downstream



Reach 1 – Permanent Photo Station 4
Cross Section 3 – Looking Downstream



Reach 1 – Permanent Photo Station 5
Cross Section 4 – Looking Downstream



Reach 1 – Permanent Photo Station 6
Cross Section 5 – Looking Downstream



Reach 1 – Permanent Photo Station 7
Cross Section 6 – Looking Downstream



Reach 1 – Permanent Photo Station 8
Cross Section 7 – Looking Downstream



Reach 1 – Permanent Photo Station 9
Cross Section 8 – Looking Downstream



Reach 2 – Permanent Photo Station 10
Cross Section 9 – Looking Downstream



Reach 2 – Permanent Photo Station 11
Cross Section 10 – Looking Downstream



Reach 2 – Permanent Photo Station 12
Cross Section 11 – Looking Downstream



Reach 2 – Permanent Photo Station 13
Cross Section 12 – Looking Downstream



Reach 3 – Permanent Photo Station 14
Cross Section 13 – Looking Downstream



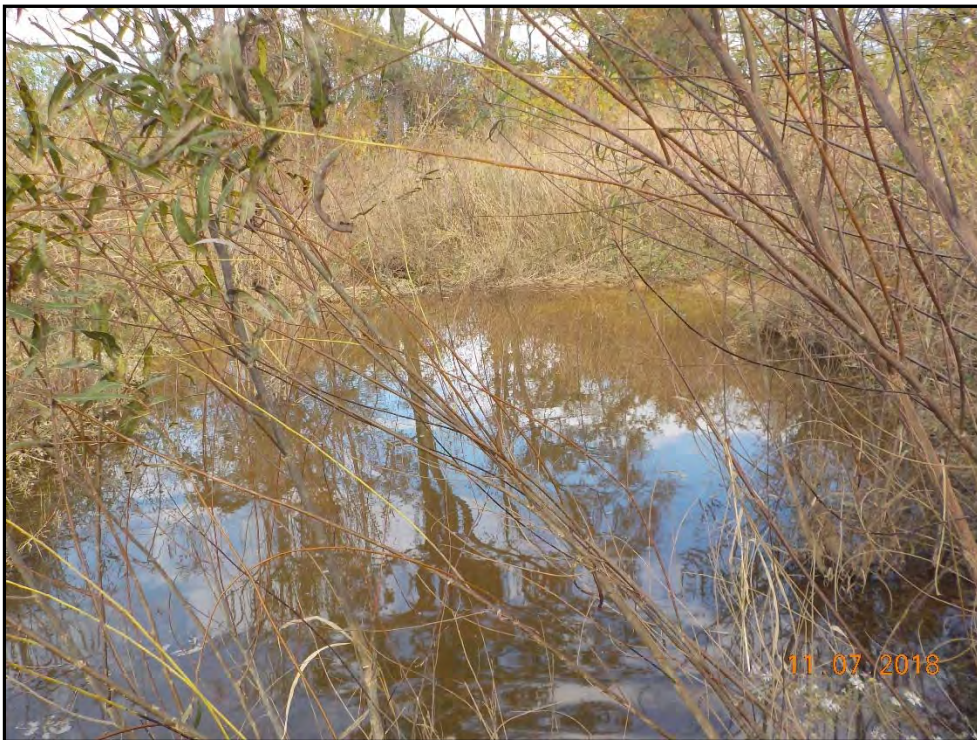
Reach 3 – Permanent Photo Station 15
Cross Section 14 – Looking Downstream



Reach 3 – Permanent Photo Station 16
Cross Section 15 – Looking Downstream



Reach 3 – Permanent Photo Station 17
Cross Section 16 – Looking Downstream



Reach 4 – Permanent Photo Station 18
Cross Section 17 – Looking Downstream



Reach 4 – Permanent Photo Station 19
Cross Section 18 – Looking Downstream



Reach 4 – Permanent Photo Station 20
Bottom of Project – Looking Upstream

Figure 4. 2018 Problem Area Photos



Reach 4 – Beaver Dam



Reach 4 – Beaver Dam

Appendix C

Vegetation Plot Data

(Not required for MY4)

Appendix D

Stream Geomorphology Data

Table 12. Pebble Count Data Summary

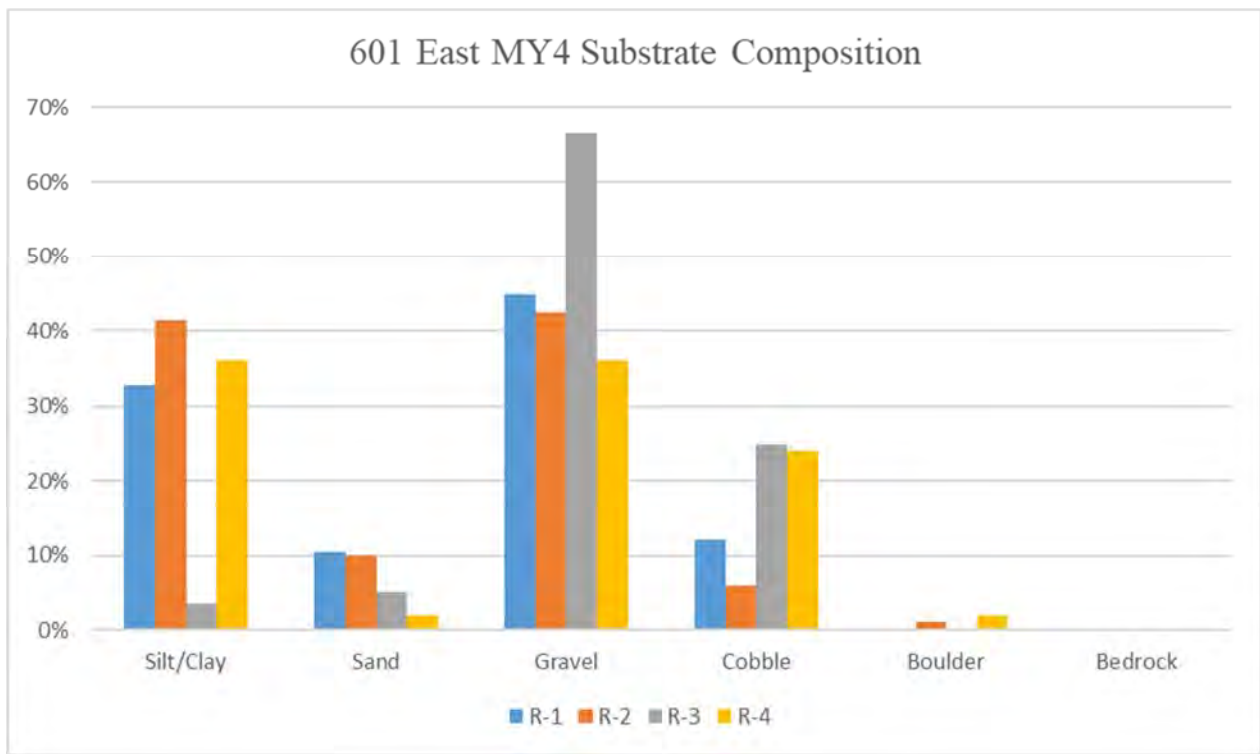
MY4 Stream Reach Substrate Composition Charts

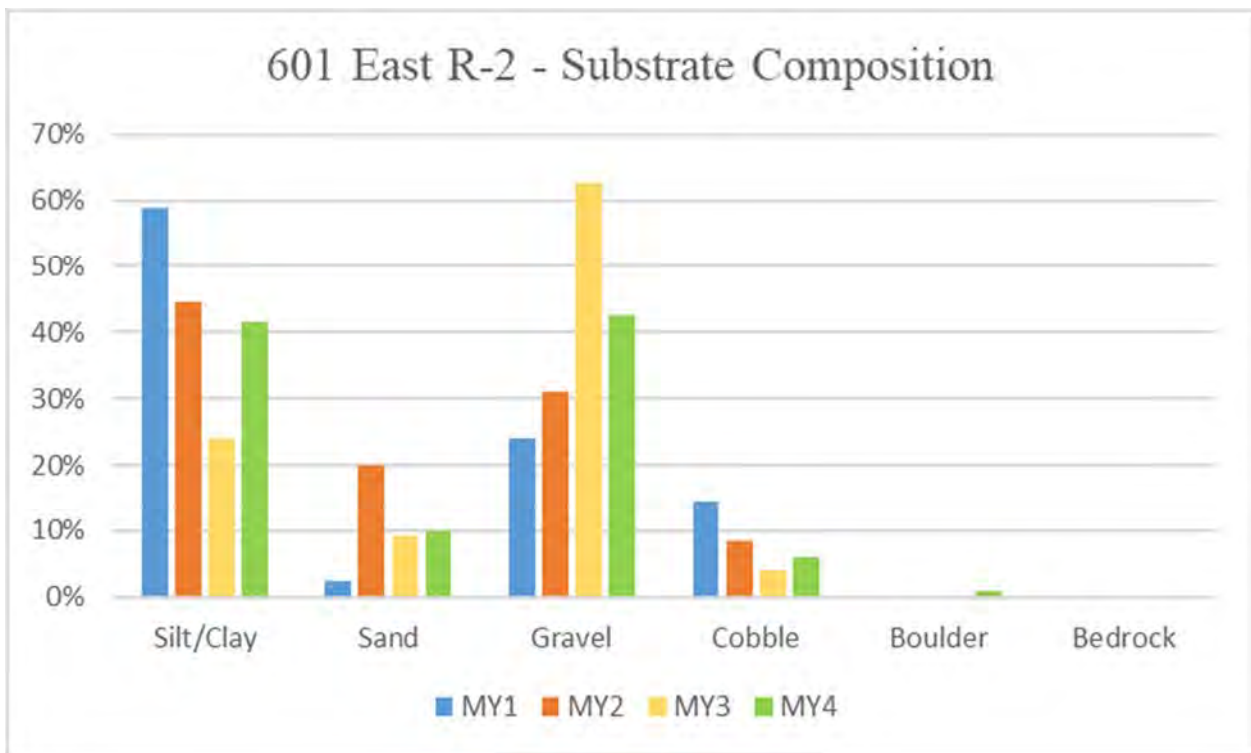
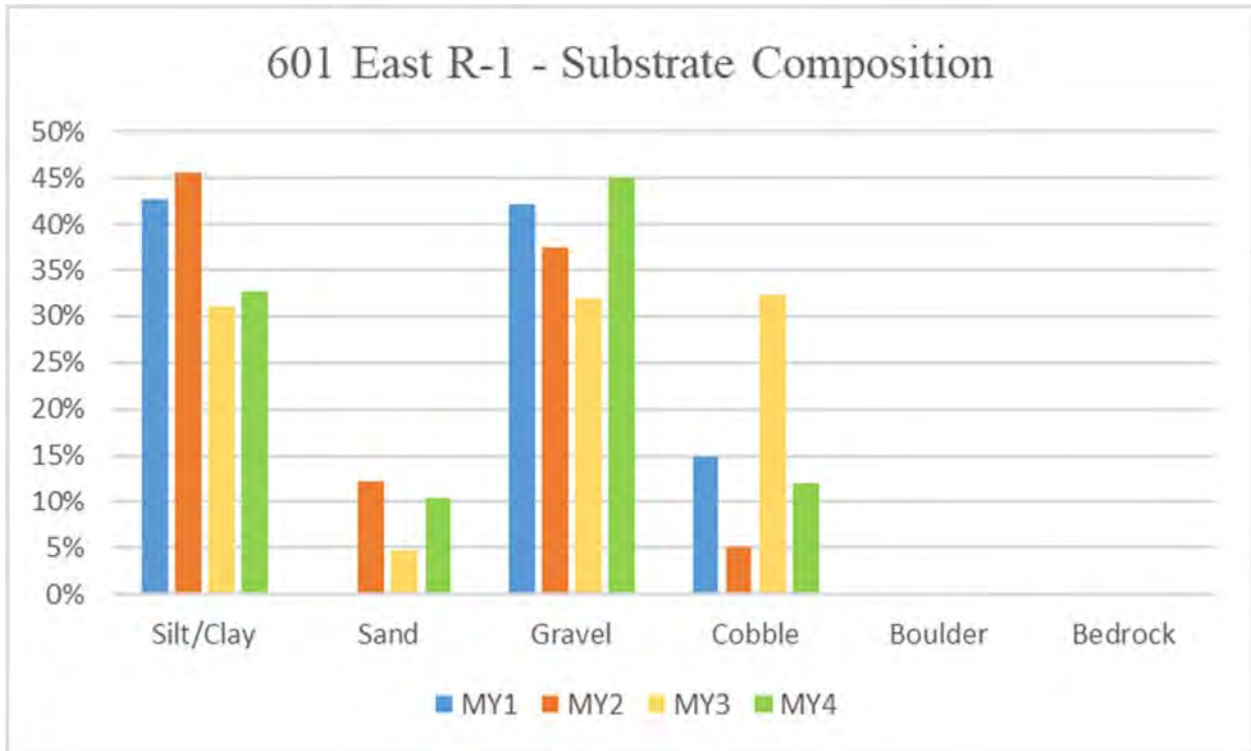
Table 13. Bank Pin Array Summary

Table 12. Pebble County Data Summary

Table 12. Pebble Count Data Summary 601 East														
Stream Reach	MY1 - 2015		MY2 - 2016		MY3 - 2017		MY4 - 2018		MY5 - 2019		MY6 - 2020		MY7 - 2021	
	Pebble Count		Pebble Count		Pebble Count		Pebble Count		Pebble Count		Pebble Count		Pebble Count	
	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)	D ₅₀ (mm)	D ₈₄ (mm)
Reach 1	14.1	48.8	4.9	25.6	25.5	87.3	4.8	48.3						
Reach 2	0.062	61	2.9	34.1	9.7	20	5.5	30.9						
Reach 3	27	79.5	6.2	39.5	73.5	140	26.5	72						
Reach 4	47	110	4.2	66	12	95	12	95						

MY4 Stream Reach Substrate Composition Charts





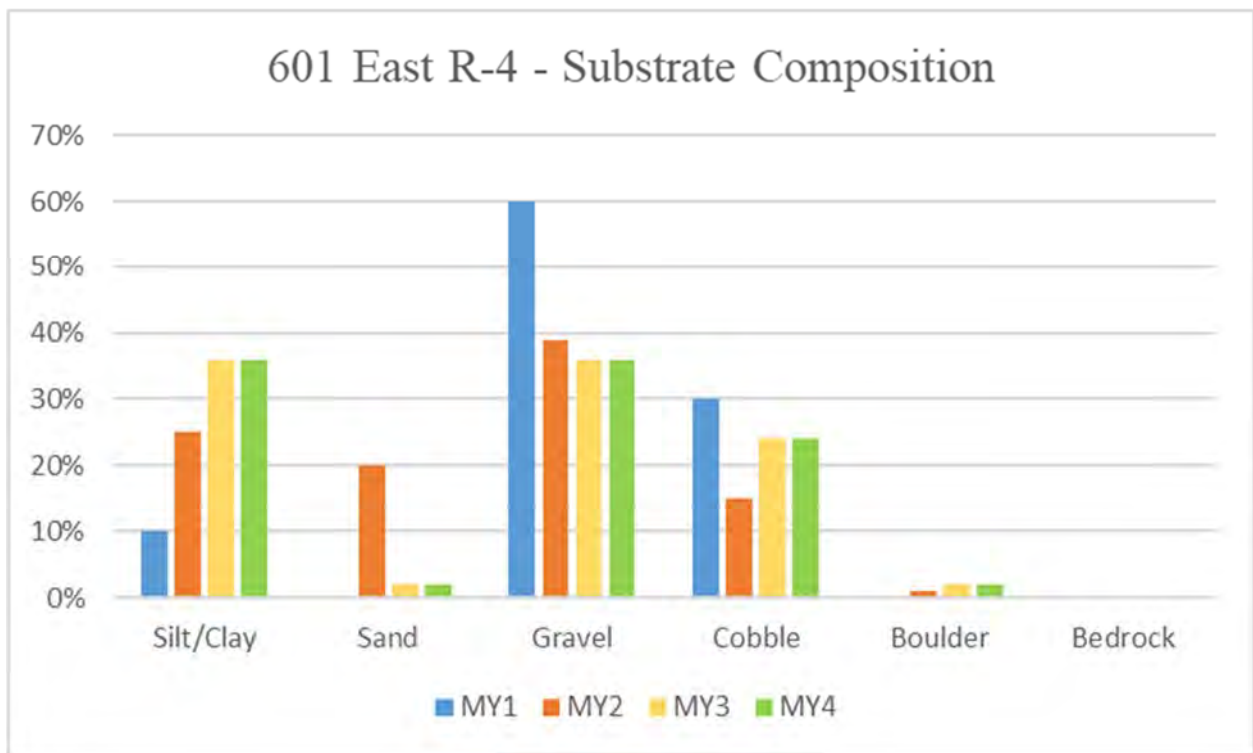
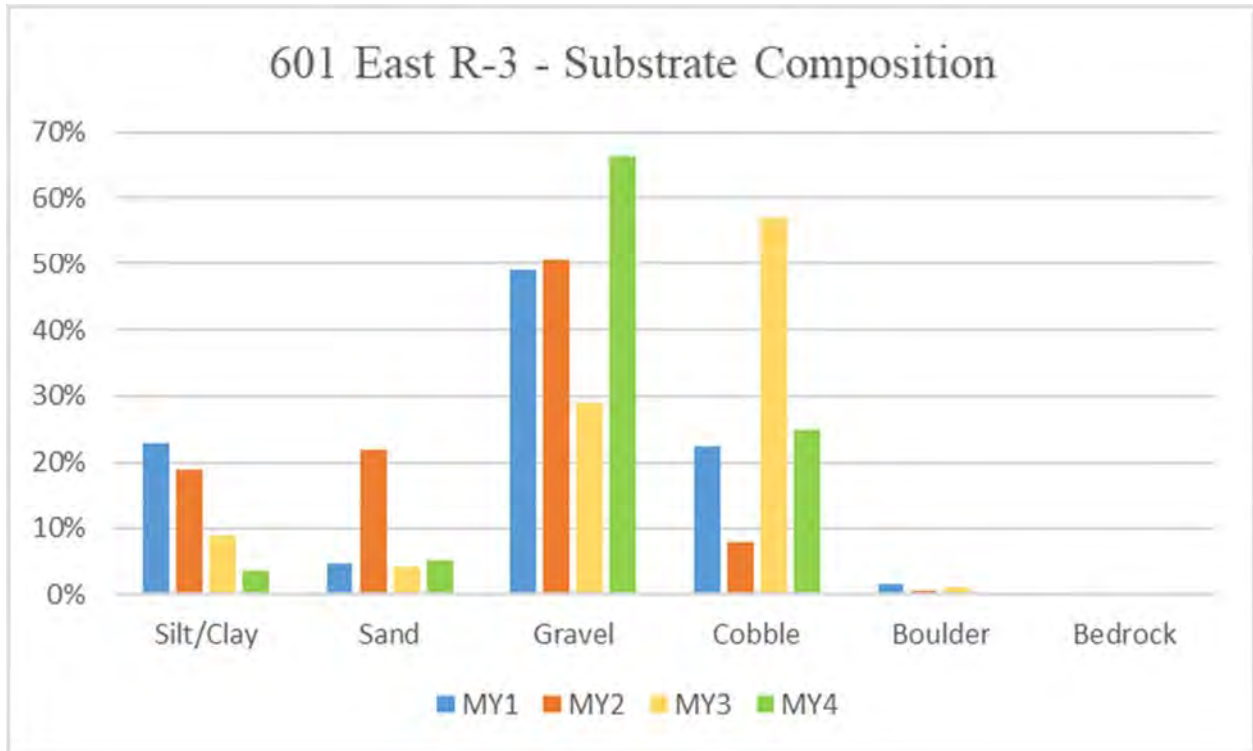


Table 13. Bank Pin Array Summary 601 E Stream Mitigation Site					
Bank Pin Location	Position	Year 1 Reading (mm)	Year 2 Reading (mm)	Year 3 Reading (mm)	Year 4 Reading (mm)
XS-1	Upstream	0.0	35.6	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0
XS-3	Upstream	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0
XS-5	Upstream	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0
XS-7	Upstream	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	12.7	0.0	0.0	0.0
XS-10	Upstream	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0
XS-12	Upstream	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0
XS-14	Upstream	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0
XS-15	Upstream	0.0	0.0	0.0	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	0.0	0.0
XS-17	Upstream	0.0	0.0	50.8*	0.0
	At Cross-Section	0.0	0.0	0.0	0.0
	Downstream	0.0	0.0	177.8*	0.0

*A beaver dam directly downstream caused unusually high water and localized bank erosion.

Appendix E

Hydrology Data

Table 14. Verification of Bankfull Events

Table 15. 2018 Rainfall Summary

Figure 7. Photo Verification of Bankfull Events

Table 14. Verification of Bankfull Events

Date of Data Collection	Estimated Date of Occurrence	Method	Maximum Bankfull Height (ft)	Photo #
Reach 2				
11/1/2015	9/30/2015	Wrack Lines	Unknown	---
3/1/2016	2/16/2016	Crest Gauge	1.4	MY2
4/25/2017	4/24/2017	Crest Gauge	2.5	MY3
7/19/2017	6/20/2017	Crest Gauge	1.3	---
10/17/2017	9/12/2017	Crest Gauge	0.7	---
11/7/2018	9/16/2018	Wrack Lines	0.66	1
Reach 3				
3/1/2016	Unknown	Crest Gauge	0.2	MY2
4/25/2017	4/24/2017	Crest Gauge	0.3	---
7/19/2017	6/20/2017	Crest Gauge	1.4	MY3
10/17/2017	9/12/2017	Crest Gauge	0.9	---
11/7/2018	9/16/2018	Wrack Lines	0.79	2

Table 15. Rainfall Summary

Month	Average	Normal Limits		Monroe Station Precipitation
		30 Percent	70 Percent	
Jan	3.9	2.68	4.65	4.47
Feb	3.29	2.45	3.85	2.43
Mar	4.22	3.02	4.98	3.95
Apr	3.29	2.01	3.98	3.81
May	3.25	1.99	3.93	2.94
Jun	4.66	2.84	5.65	2.65
Jul	4.34	2.83	5.21	3.30
Aug	4.76	3.00	5.75	4.73
Sep	4.46	2.4	5.44	12.36
Oct	3.88	1.89	4.66	5.59
Nov	3.38	1.86	4.12	6.83
Dec	3.6	2.58	4.25	---
Total	47.03	29.55	56.47	53.06

Figure 7. Photo Verification of Bankfull Events



Wrack lines @ Crest Gauge Reach 2 – 0.66 feet



Wrack lines @ Crest Gauge Reach 3 – 0.79 feet

Appendix F

MY3 Adaptive Management Memo



302 Jefferson St. Suite 110
Raleigh, NC 27605

Corporate Headquarters
5020 Montrose Blvd. Suite 650
Houston, TX 77006
Main: 713.520.5400

May 3, 2018

Paul Wiesner
NCDEQ – DMS
5 Ravenscroft Drive
Asheville, NC 28801

RE: 601 East Stream Restoration Project – MY3 Adaptive Management Memo

Mr. Wiesner,

In response to the discussion at the Credit Release meeting regarding the adaptive management work done at 601 East, RES has prepared this memo to provide documentation of the activities performed in late March 2018.

1. Encroachment areas near Reach 3 and 4

RES addressed the encroachment areas on Reach 3 and 4. The work included adding posts and tape to block off the encroachment area as well as repairing the appropriate crossing outside of the easement near VP5. RES also found another encroachment area on Reach 4 during a site visit in early 2018. This area is near the end of the project and was remarked with additional posts. Both impacted areas were replanted with about 200 three-gallon container trees.

2. Beaver dams on Reach 4

RES removed the beaver dams on Reach 4. The dams were completely taken out and the banks were stabilized with seed, straw, and livestock.

3. Invasive species

RES treated the invasive species on site. The treatment included the Parrot Feather on Reach 2 and the Chinese Privet on Reach 4. The Parrot Feather was treated with an aquatic herbicide as an experiment and the results will be reported at the end of MY4. Cattails were not treated because populations are isolated and are not negatively affecting the growth of planted trees.

4. Bare area on Reach 1

RES replanted about 50 three-gallon container trees in the 0.05-acre bare area on Reach 1.

Attached are photos and maps associated with the activities described above. Invasive species treatment will continue throughout the monitoring period as needed and RES will continue to keep a close watch on possible encroachment and beaver issues.

Thank you,

A handwritten signature in black ink that reads "Ryan Medric".

Ryan Medric | Ecologist



Encroachment area planting and easement marking near VP5. (3/27/2018)



Encroachment area planting and easement marking on Reach 4. (3/27/2018)



Crossing repair near VP5. (3/27/2018)



Crossing repair near VP5. (3/27/2018)



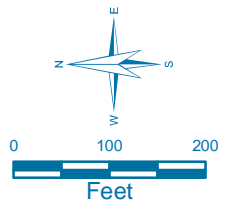
Beaver dam removal and bank stabilization near XS17. (3/27/2018)



Beaver dam removal and bank stabilization downstream of XS18. (3/27/2018)



Bare area planting near the crossing on Reach 1. (3/27/2018)



1 inch = 200 feet

Figure 1

**601 East Stream
Restoration Project
MY3 2017 - AMP**

**Current Conditions
Plan View**

Date: 5/3/2018

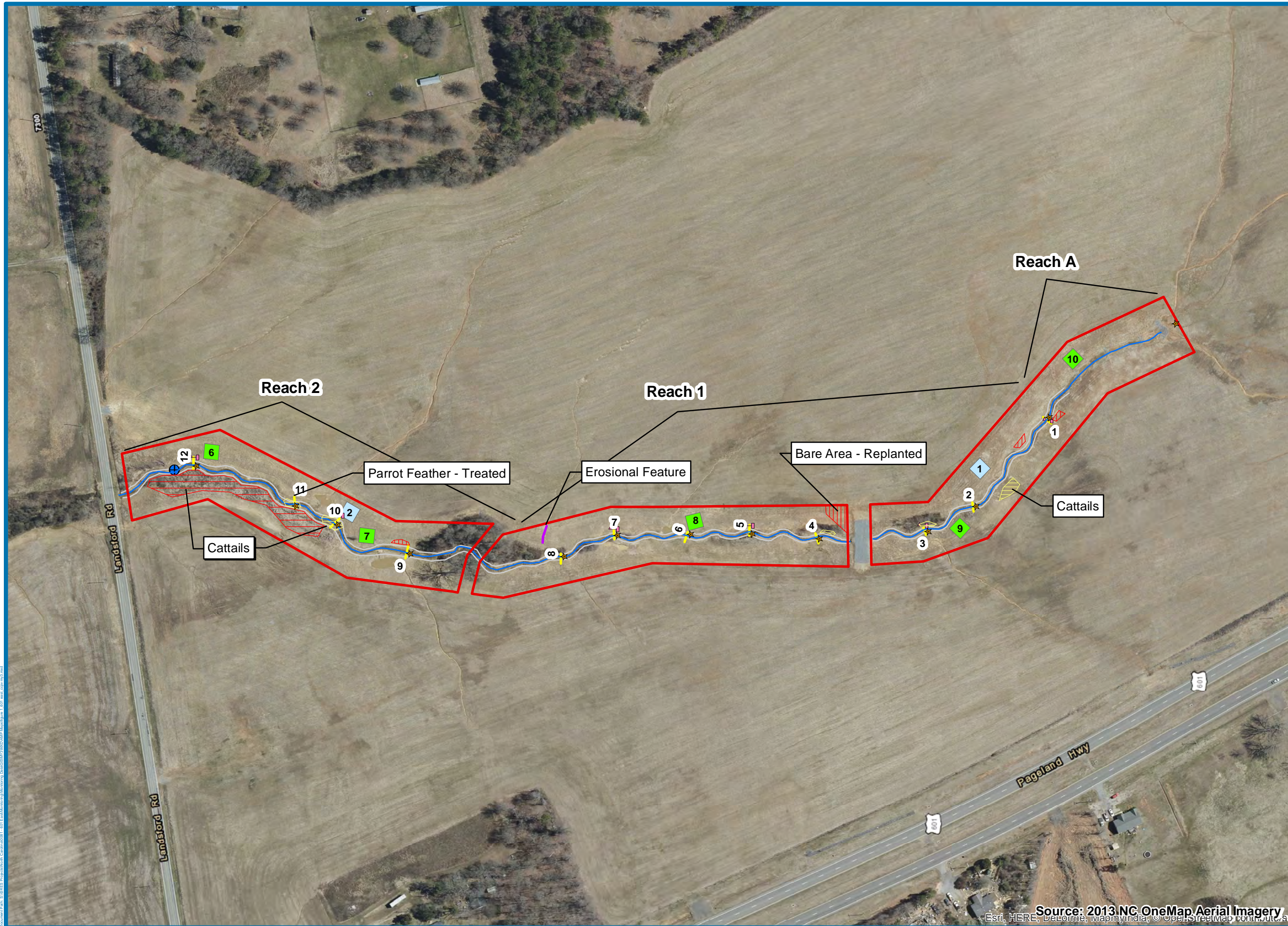
Drawn by: RTM

LEGEND

- ▭ Conservation Easement
- ★ Photo Station
- Stream
- ▭ Bankpin Array
- Cross Section
- ⊕ Crest Gauge
- Structure
- Top of Bank
- MY3 SPAs
- Vegetation Success**
- Criteria Met
- Temporary Plot

Riparian Buffer Conditions

Invasive Species	Target Community		
	Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



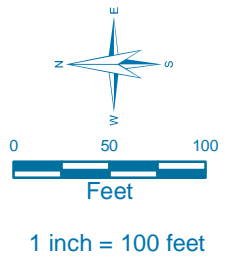


Figure 2

**601 East Stream
Restoration Project
MY3 2017 - AMP**

**Current Conditions
Plan View**

Date: 5/3/2018

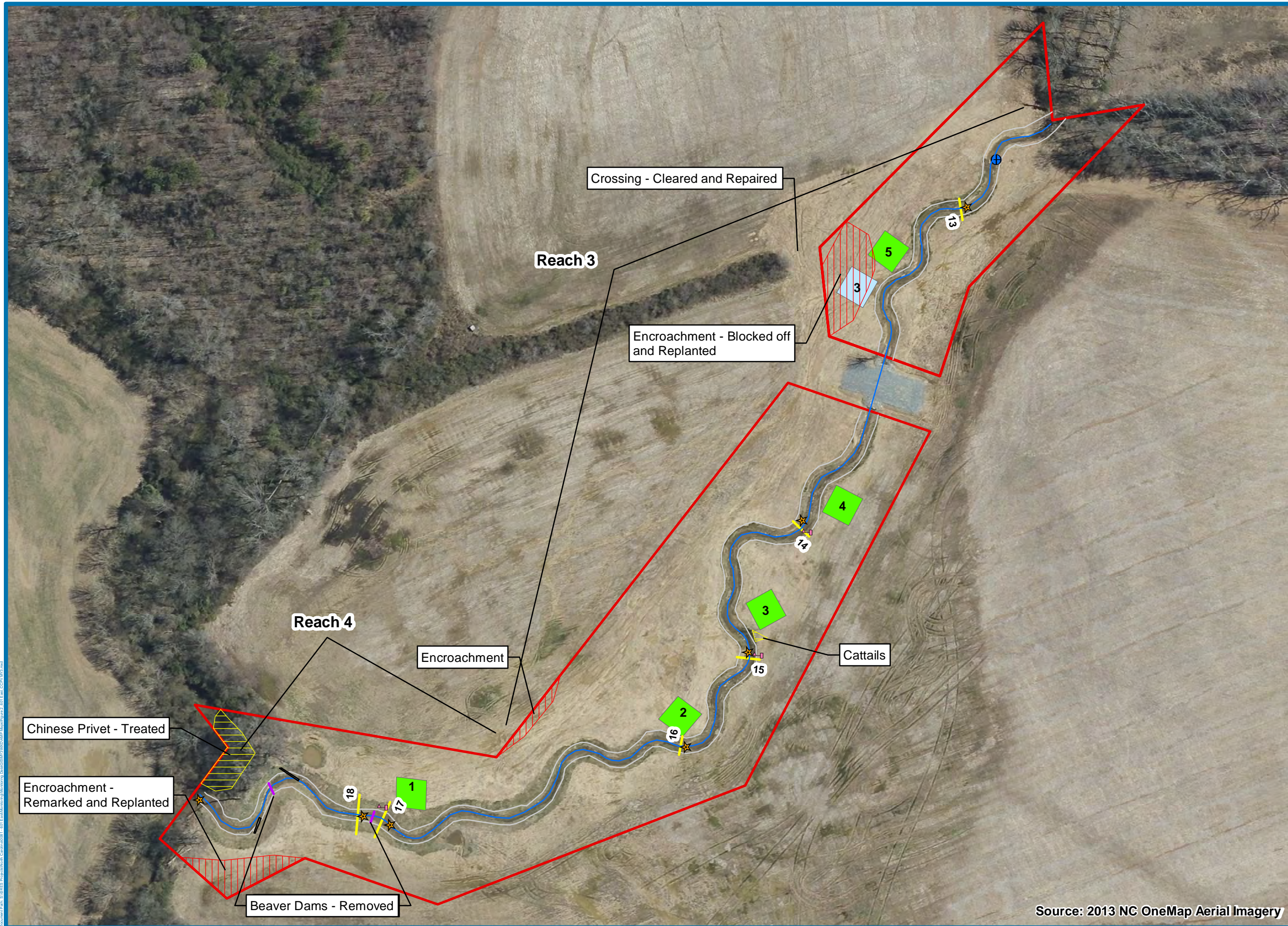
Drawn by: RTM

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Source: 2013 NC OneMap Aerial Imagery